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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/801,630	03/08/2001	Kars-Michiel Hubert Lenssen	NL 000094	8319

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EXAMINER	
DOLAN, JENNIFER M	
ART UNIT	PAPER NUMBER
2813	9

DATE MAILED: 02/27/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/801,630	LENSSEN, KARS-MICHIEL HUBERT	
	Examiner	Art Unit	
	Jennifer M. Dolan	2813	

-- The MAILING DATE of this communication appears on the cover sheet with th correspond nce address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 November 2002* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4 and 6-16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4 and 6-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

This action is in response to Amdt. A, filed 11/18/02

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in-
> (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or
> (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

2. Claims 1-4, 6-8, and 13-15 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No 6,175,475 to Lin et al.

Regarding claims 1, 13, and 15 Lin discloses a data storage system (column 1, lines 12 – 19) comprising a set of structures (figure 4) including: a first structure of layers (430, 420, 415, 410) including at least a first ferromagnetic layer (420) and a second ferromagnetic layer (410) with at least a separation layer of a non-magnetic material therebetween (415; figure 4), the first structure having at least a magnetoresistance effect (column 1, line 41 – column 2, line 3); a second structure (406 and 432) including at least one magnetic layer (406 and 432), the second structure influencing at least one intrinsic magnetic characteristic of the first structure (bias field/magnetic moment, column 3, lines 15 – 27); and the second structure being separated from the first structure by at least a spacer layer (408), wherein the non-magnetic material is a metal (column 5, lines 12 – 14) and the spacer layer comprises a high-resistive metallic material (column 5, lines 17 – 23). It is inherent that the spacer layer causes a mainly ferromagnetic

coupling of the second structure on the first structure while not substantially influencing the magnitude of the magnetoresistance effect of the first structure, because the Ta layer separating the first and second structures is sufficiently thin (5 nm from column 5, lines 17 – 19) for ferromagnetic coupling to be the dominant coupling mechanism between the two layers, and because the Ta layer has sufficiently high resistivity to prevent the second structure from influencing the magnetoresistance of the first structure. Regarding claim 15, it is an inherent property of the sensor of Lin that 'a magnetoresistance characteristic *can* be tuned' by adjusting a thickness of the high-resistive metallic material.

Regarding claim 2, Lin discloses that the second structure comprises at least one layer (432) of a magnetic material of a high coercivity.

Regarding claim 3, Lin discloses that the second structure comprises at least one layer (432) of an exchange biasing material.

Regarding claim 4, Lin discloses that the second structure comprises a layer (406, 432) that has a magnetization direction that is substantially anti-parallel with respect to the magnetization direction of the first ferromagnetic layer (column 3, lines 15 – 18).

Regarding claims 6 and 14, Lin discloses that the high-resistive metallic material is Ta (column 5, lines 17-18), which inherently induces a crystallographic characteristic on layers deposited upon it (column 4, lines 63 – 67), in this case, the second structure.

Regarding claim 7, Lin discloses that the high resistive metallic material is Ta (column 5, lines 17 – 18).

Regarding claim 8, Lin discloses that the high-resistive metallic material has a thickness of 5 nm (column 5, lines 16 – 19), which is in the range of one atomic layer up to 15 nm.

3. Claim 16 is rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No 6,127,053 to Lin et al.

Lin discloses a magnetic system such as a data storage system or a sensing system of a magnetic characteristic (column 1, lines 8 – 11), the system comprising a set of structures (figure 8) including: a first structure of layers including at least a first ferromagnetic layer structure (420) and a second ferromagnetic layer (410) with at least a separation layer of a non-magnetic material therebetween (415), the first structure having at least a magnetoresistance effect (column 1, line 53 – column 2, line 13); a second structure including at least one magnetic layer (406), the second structure influencing at least one intrinsic magnetic characteristic of the first structure (column 2, lines 19 – 29); the second structure being separated from the first structure by at least a spacer layer (408) of a high-resistivity metallic material (column 7, lines 26 – 27) furthermore influencing the coupling of the second structure on the first structure while not substantially influencing the magnitude of the magnetoresistance effect of the first structure (column 6, lines 39 – 50; column 2, lines 19-29; also, it is inherently the case that the second structure will not substantially influence the MR effect of the first structure, since the Ta spacer only allows the second structure to weakly couple to the first structure). Lin further discloses that the first ferromagnetic layer structure can comprise 2 non-abutting ferromagnetic layers (column 11, lines 60 – 61 and figure 7b and 8), while the second structure comprises 1 ferromagnetic layer (406). Thus, Lin discloses that the first ferromagnetic layer structure and second structure respectively comprise an even number of non-abutting ferromagnetic layers and an odd number of non-abutting ferromagnetic layers.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lin et al. '475 in view of U.S. Patent No. 6,166,539 to Dahlberg et al.

Lin discloses that the layer of high-resistive material is made of Ta, Al_2O_3 or SiO_2 (column 5, lines 17 – 18 and column 6, lines 26 – 28).

Lin fails to disclose a metallic polymer with a conductivity in the range of the conductivities of the group of Ti, Zr, Hf, etc.

Dahlberg discloses that polyimide can be used in place of Al_2O_3 or SiO_2 in a magnetic head (column 16, lines 42 – 43).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to replace the layer of high-resistive material of Lin with a polymer, as taught by Dahlberg. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would have been motivated to substitute the polymer for the high-resistive material, because Dahlberg shows that they can be used interchangeably.

6. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lin et al. '475 in view of U.S. Patent No. 6,178,072 to Gill.

Lin discloses that the second structure is separated from the first structure by a layer selected from a group including high-resistive metallic materials (Ta) and insulating layers (Al_2O_3, SiO_2) (column 5, lines 17 – 18 and column 6, lines 26 – 28).

Lin fails to disclose that the spacer comprises a layer of a high-resistive metallic material and an insulating layer abutting the high-resistive layer.

Gill discloses a spacer comprising a layer of high-resistive metallic material (308) and an insulating layer (306) abutting the layer of high-resistive metallic material.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the magnetoresistive structure of Lin, so that the spacer includes the high-resistivity material abutting an insulating layer, as taught by Gill. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would have been motivated to provide an insulating layer abutting a high-resistivity layer, in order to prevent shunting of the magnetoresistive sense current of the first structure through the second structure. This allows the second structure to be designed in such a way that read signal symmetry and greater thermal stability are achieved (Gill, column 3, lines 15 – 24).

7. Claims 9 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin et al. '475 in view of U.S. Patent No. 6,114,719 to Dill et al.

Regarding claim 9, Lin discloses a spacer layer made of a Ta, which is a high-resistive metallic material (column 5, lines 17 – 18).

Lin fails to disclose that the high-resistive metallic material is made of Cr, Mo, or W.

Dill discloses a nonmagnetic spacer layer made of Cr (column 7, lines 4-8).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the spacer layer of Lin so that it is made of Cr, as taught by Dill. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would have been motivated to use Cr for the spacer layer, since it is a recognized art equivalent to Ta as a nonmagnetic high-resistivity spacer material (Dill, column 7, lines 5-7), and thus Cr and Ta can be used interchangeably in this capacity.

Regarding claim 12, Lin teaches a magnetoresistive read sensor, but fails to disclose a magnetic memory structure.

Dill discloses a magnetic memory structure (column 1, lines 45 – 50).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the magnetoresistive structure of Lin so that it can be used in memory structures, as taught by Dill. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would have been motivated to use the magnetoresistive structure in a memory structure, because equivalent structures can be used for both solid state memory and external magnetic field read sensors (Dill, column 1, lines 45 – 50). Thus, it is well within the purview of a person having ordinary skill in the art to use a magnetoresistive sensing structure in either a memory structure or a magnetoresistive read head.

Response to Arguments

8. Applicant's arguments filed 11/18/02 have been fully considered but they are not persuasive.

Regarding claims 1 and 13-16, the applicant argues that Lin '475 fails to teach that the 'spacer layer furthermore causing a mainly ferromagnetic coupling of said second structure on said first structure while not substantially influencing the magnetoresistance effect of the first structure. On the contrary, Lin '475 teaches that the "second spacer" [...] provides magnetic isolation."

This is not persuasive, because it is inherently the case that the metallic magnetic films of Lin '475, when deposited under normal conditions, exhibit the roughness which leads to "orange-peel" topological coupling, which is a mainly ferromagnetic coupling, in a similar manner to that in the present application (see Parkin, column 8, lines 11-29 and Slaughter, column 2, lines 1-13). Although Lin '475 does not specifically point out the ferromagnetic coupling, due to the orange-peel coupling effect, it must inherently be present in the structure of Lin. Additionally, while Lin '475 may state that the second spacer provides a magnetic isolation, the second spacer of Lin, which is provided in a preferred embodiment as 5 nm of Ta (column 7, lines 3-5) is not dissimilar to the spacer of about 2-15 nm of Ta in the present application (see page 6, lines 26-28), and would thus provide the same degree of magnetic isolation as the Ta spacer in the present application. Because both the structure in Lin '475 and the structure in the present application comprise, in order, a stacked AMF, pinned layer, Cu spacer, free layer, 2-15 nm Ta high resistivity spacer, second pinned layer, and second AFM layer, and because ferromagnetic "orange-peel" coupling is inherent to a structure with thin metallic layers, the

structures of Lin '475 and the present application are understood to have similar coupling and isolation properties between the first and second structures.

Regarding claim 14, the applicant further argues that Lin '475 fails to teach that the high-resistive metallic material at least partially induces a crystallographic characteristic on the second structure.

This is not persuasive, because Lin '475 discloses that the second spacer is Ta, which is well known and established in the art as a seed layer used to provide crystallographic texture to overlying magnetic layers (see Lin, column 4, lines 63 – 67). Thus, the second spacer of Lin, made of Ta, will inherently induce crystallographic texture on the keeper layer of the second structure.

Regarding claim 15, the applicant argues that Lin '475 does not disclose the tuning of the magnetoresistance characteristic, nor does Lin recognize that such tuning can be accomplished by adjusting the thickness of the second spacer.

This is not persuasive, because the language of the claim only specifies that the "magneto resistance characteristic *can* be tuned by adjusting a thickness of the high-resistive metallic material." This limitation does not affect the structure of the claimed product in any way, but rather provides a method of use, and thus the limitation is only given patentable weight to the extent that it affects the structure. Although Lin '475 is silent as to tuning of the magnetoresistance characteristic, it is certainly the case that the structure of Lin, which is not dissimilar to the structure of the present application, is capable of having a magnetoresistance characteristic tuned by adjusting a thickness of the metallic material, because doing so will increase or decrease the strength of the inherently present "orange-peel coupling".

Regarding claim 16, the applicant further argues that the Examiner has not provided any evidence that the second structure will not substantially influence the MR effect of the first structure.

This is not persuasive, because Lin '053 establishes that the second structure only provides a flux closure path, to compensate for the magnetostatic interaction between the free and pinned layers (see Lin '053, column 6, lines 39 – 50; column 2, lines 19-29). Additionally, it has been established by Lin '475 that the Ta spacer largely provides magnetic isolation between the first and second structures (column 5, lines 21-24). Finally, both the structure in Lin '053 and the structure in the present application comprise, in order, a stacked AMF, pinned layer, Cu spacer, free layer, 2-15 nm Ta high resistivity spacer, second pinned layer, and second AFM layer, and because the same ferromagnetic "orange-peel" coupling is inherent to a structure with thin metallic layers, and the Ta spacer will provide similar isolation properties, the structures of Lin '053 and the present application are understood to have similar properties with respect to influencing the MR effect of the first structure.

Conclusion

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period

will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Dolan whose telephone number is (703) 305-3233. The examiner can normally be reached on Monday-Friday 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl W. Whitehead, Jr. can be reached on (703) 305-4940. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9318 for regular communications and (703) 872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Jennifer M. Dolan
Examiner
Art Unit 2813

jmd
February 21, 2003

CARL WHITEHEAD, JR.
SUPERVISORY PATENT EXAMINER
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